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UNLOADER FOR DISCHARGING DRY MATERIALS FROM BULK BAGS

BACKGROUND

1. Field of Invention

This invention relates to unloaders for discharging dry and semi-dry materials from bulk bags.

2. Description of Related Art

As many processors improve their operations by using bulk bags, instead of handling and manually dumping 50 lbs. and 100lbs. paper bags, the need for a safer, more compact and flexible frame design of bulk bag unloaders has grown.

One of the more vexing problems in handling bulk bags is the requirement of a tall, four-posted frame with a cantilevered I-Beam that extends outward at the top of the frame so that a bulk bag can be lifted from its pallet on the floor up and onto the discharge apparatus of the unloader frame. The typical unloader frame is generally equipped with several diagonal and horizontal bracing structures between the four vertical, corner posts and hoist apparatus. This extra bracing around the frame makes it difficult to interface other types of feeding, dust collection and discharge equipment close to the discharge spout location of the bulk bag. Other problems and hazards are created when lifting a heavy bulk bag with the extended I-Beam configuration.

SUMMARY

It is the object of the invention to use a smaller footprint for a bulk bag unloader.

Another object of the invention is lift and discharge a bulk bag on a standard sized unloader frame without the use of a cantilevered I-Beam.

Another object of the invention is to provide a safer method of lifting a bulk bag for unloading.

Yet another object of the invention is to provide a more open and

accessible frame around the bulk bag when it placed on the unloader.

Another object of the invention is to use a pick-up location and discharge location within the area of a four-posted unloader frame.

Another object of the invention is to allow other types of conveying, dust collection and metering devices to be interfaced with the unloader frame closer to the discharge spout of the bulk bag.

Yet another object of the invention is to eliminate the use of secondary bracing structures on the unloading frame.

Another object of the invention is to provide greater flexibility to where the horizontal frames may be located on the four-vertical posts.

DRAWINGS

FIG. 1 is a side view of a bulk bag unloader with one bag positioned for discharge while a second bag is staged on the floor waiting to be lifted into position and discharged.

FIG. 2 is a side view of a bulk bag unloader frame with the hoist in position to lift a full bulk bag from its pallet on the floor to the discharge position.

FIG. 3 is a front view of a bulk bag lowered over the base ram and tray support for discharging.

FIG. 4 is a top of a bulk bag unloader with an open side and offset discharge location.

FIG. 5 is a side view of a bulk bag unloader showing details of the bag support means.

FIG. 6 is a side view of an unloader bag support hopper having massage paddles.

FIG. 7 is a top view of the hopper of FIG. 6.

FIG. 8 is a side view of the hopper shown in FIG. 6 with a bag starting to be unloaded.

FIG. 9 is a side view of the hopper and bag shown in FIG. 8 with the bag unloaded.

FIG. 10 is a top view of the mounting base showing a bottom actuator manifold and pressure regulator.

FIG. 11 is an end view of an unloader of a bag lifted over a hopper for discharge, and the vertical centers of gravity of the bags being inside the frame.

FIG. 12 is a front view of an unloader having a plurality of platform hoppers.

DESCRIPTION

FIG. 1 is a side view of unloader frame 20. Top frame support 21 is equipped with corner brackets 21x and 21y (21v and 21z not shown) and bottom frame 21a is equipped with corner brackets 21ax and 21ay (21av and 21az not shown) to secure corner posts 22a and 22b (22c and 22d not shown) in position to form unloader frame 20. Unlike other bulk bag unloaders, I-beam 23 does not extend outside of the perimeter of corner posts 22a, 22b, 22c and 22d. I-beam 23 is secured to top frame 21 and allows hoist 25 to move between posts 22a and 22b via trolley 24. Bag 29a is held in position by bag support frame 28 and bag support tray 85. Bag support tray 85 may be located off center within the four corner posts 22a, 22b, 22c and 22d. Bag 29b is on pallet 84 in a location within the four corner posts 22a, 22b, 22c and 22d so that it can be lifted with hoist 25 when moved to the left end of I-beam 23. Corner brackets 21ay, 21ax, 21av and 21az of bottom frame 21a are designed to provide lateral support and can be located any where along the corner posts 22a, 22b, 22c and 22d to allow for the height of bag support tray 85 to be adjustable. Corner brackets 21x, 21v, 21y and 21z also add lateral support and rigidity to unloader frame 20 and may also be secured at any elevation.

FIG. 2 is a side view of unloader frame 20 with hoist 25 moved along I-beam 23 via trolley 24 to a position over bag 29b. Chain 26 and bag frame 28 are lowered for bag to be lifted. Bag 29b is staged in the open frame area of unloader 20 on floor 50. Bag support tray 85 is empty, ready for bag 29b to be positioned thereon.

FIG.3 is a front view of unloader frame 20 with bag 29b lowered onto ram base 35 and bag support frame 85. Bottom frame 21a does not have a support member located between vertical posts 22a and 22d to provide an open area directly under I-beam 23, trolley 24 and hoist 25.

FIG. 4 is a top view of bottom frame 21a secured to vertical posts 22a, 22b, 22c and 22d. Bag support tray is supported by cross beam supports 86a and 86b. Pallet 84 is shown on floor in an open area of unloader frame 20. Because a cross support brace is not used between vertical posts 22a and 22d of bottom frame 21a and the bag support tray 85 is located off center of unloader frame 20, the I-Beam and Hoist Assembly (not shown) do not have to extend beyond vertical posts 22a, 22b, 22c and 22d.

FIG. 5 is an end view of the lower section of the unloader with seat housing 95 secured to vertical support post 22a. Axle 97 of seat frame 96 is placed inside seat housing 95 to allow seat frame 96 to swivel off support post 22a. Seat extension support 99, with seat 100 attached, is mounted to seat frame 96 at pivot joint 98. Seat 100 may be mounted in a stationary position or in a swivel and foldable configuration as shown, to assist operator with the set up and discharge of a bulk bag on the unloader. It is understood that any configuration of the unloader may be provided with a seat 100, and not just the configuration shown in Fig. 5.

To provide the unloader with a variety of discharge options to handle different sized bags and / or materials with varying flow characteristics, bag support hopper 87 is equipped with hopper brackets 88a and 88b (88c and 88d not shown) that may be supported by unloader frame brackets 89a and 89b (89c and 89d not shown) on horizontal support frames 21a and 21b (21c and 21d not shown). Bag support hopper 87 may be provided as a rectangular or conical shape with various slope angles. Spacers 90a and 90b (90c and 90d not shown) are positioned between hopper brackets 88a and 88b (88c and 88d not shown) and unloader frame brackets 89a and 89b (89c and 89d not shown). Spacers 90a and 90b (90c and 90d not shown) may be interchanged with vibration isolators, load cells or other discharge devices as the configuration dictates. It is intended that the vibration isolators, load cells, and other discharge devices fit in the same space as the spacers as shown in Fig. 5 to facilitate manufacture and / or reconfiguration of the unloader. Spacers 90 may be supplied in one or more units as required to support bag support hopper 87. If vibration is desired to assist in breaking up settled material inside the bulk bag, a vibrator may be secured to

vibration flange 91 and vibration isolators used instead of spacers 90. Hopper flange ring 92 on bag support hopper 87 is equipped with accessory mounting flange 92a. Discharge device 94, such as iris valve which is attached discharge device plate 93 may be fastened together using bolts, welds or with a V-band type clamp. Discharge device 94 may include valves, surge hoppers, filters, conveyors and the like.

FIG. 6 is a side view a bag support hopper with mounting base 101 that may be secured to unloader frame brackets 89a, 89b, 89c and 89d (not shown) of unloader 20 (not shown.) To provide agitation to materials shipped in bulk bags, unloaders are often equipped with plunger devices and stretching mechanisms to empty bulk bags. These devices often require several feet of elevation space for mounting and operation. Mounting base 101 is equipped with pivoting massage paddles 104a and 104b to form a platform for bulk bags to be placed upon for unloading. When lower group of bottom actuators 107a and 107b; and upper group of top actuators 108a and 108b are deflated and at rest, massage paddles 104a and 104b form a shallow hopper surface of approximately 15 degrees with an elevation height of only about 30 cm (12 inches). Hopper flange ring 92 is attached to mounting 101 and may use an internal hopper ring 102 inside to direct the flow of material from a bulk bag (not shown) through a smaller valve or outlet opening of accessory mounting flange 92a. Internal hopper ring 102 may have a vibrator (not shown) secured to it to help promote the flow of material from a bag. Top hinge ring plate 103 is secured to hopper flange ring 92 and mounting base 101 to provide support for hinges 105a, 105c, 105d, 105e and 105b. Massage paddle assemblies that attached to hinges 105c, 105d and 105e are not shown. Sandwiched between the top actuators 108a and 108b and bottom actuators 107a and 107b are hinge plates 106a and 106b respectively. Massage paddles 104a and 104b; and hinges plates 106a and 106b incline and pivot inward using hinges 105a and 105b when bottom actuators 107a and 107b and or 108a and 108b are inflated with compressed air. As bottom actuators 107a and 107b and/or top actuators 108a and 108b are inflated, the angle of massage paddles 104a and 104b is increased to help dispense material in bag.

Bottom restraints 110a and 110b are secured to mounting base 101 and

hinge plates 106a and 106b to limit movement of actuators 107a and 107b. Actuators 107a, 107b, 108a and 108b may rupture or become damaged if their movement is not limited by some type of mechanical linkage or stopping device. Bottom and top restraints 110a, 110b, 111a and 111b may be made of cable, chain or other types of linkage components. To provide a protective guard over and around the moving parts of adjustable bag hopper 114 assembly, including massage paddles 104a and 104b, hinge plates 106a and 106b and actuators 107a, 107b, 108a and 108b, flexible cover 112 is secured to the perimeter of mounting frame 101 at side joints 113a and 113b and over massage paddles 104a and 104b via top plates 109a and 109b.

FIG. 7 is a top view of adjustable bag hopper 114 with base mounting frame 101 having top hinge ring plate 103 with hinges 105a, 105b, 105c, 105d, 105e, 105f, 105g and 105h secured to it. Massage paddles 104a, 104b, 104c, 104d, 104e, 104f, 104g and 104h; and hinge plates 106a, 106b, 106c, 106d, 106e, 106f, 106g and 106h are secured to hinges 105a, 105b, 105c, 105d, 105e, 105f, 105g and 105h respectively.

To move the top surface of massage paddles 104a, 104b, 104c, 104d, 104e, 104f, 104g and 104h from an angle of approximately 15 to 30 degrees to a maximum angle of approximately 70 to 85 degrees to help agitate and empty the contents of a bulk bag (not shown), bottom actuators 107a, 107b, 107c, 107d, 107e, 107f, 107g and 107h are secured to mounting base 101 and hinge plates 106a, 106b, 106c, 106d, 106e, 106f, 106g and 106h together with top actuators 108a, 108b, 108c, 108d, 108e, 108f, 108g, and 108h secured to hinge plates 106a, 106b, 106c, 106d, 106e, 106f, 106g and 106h to massage paddles 104a, 104b, 104c, 104d, 104e, 104f, 104g and 104h respectively. Massage liner plates 109a, 109b, 109c, 109d, 109f, 109g and 109h may be used to hold flexible cover 112 massage paddles 104a, 104b, 104c, 104d, 104e, 104f, 104g and 104h respectively if flexible cover 112 (not shown) is used with adjustable bag hopper 114. Cover ring 115 (not shown) is placed on top of flexible cover 112 and top hinge ring plate 103 around opening 116 to hold the edge of flexible cover 112 in place. Because many bulk bags are rectangular in shape and therefore materials does not always empty out of its corners even when stretched or otherwise

massaged, corner massage paddles 104c, 104e, 104h and 104f are very effective in emptying bulk bag because they incline to a steep angle of about 80 to 90 degrees and push directly against the corners of a bag. In addition to corner massage paddles 104c, 104e, 104h and 104f, side massage paddles 104d, 104b, 104g and 104a also incline to an angle of about 80 to 90 degrees to form a very steep sided hopper, capable of discharging almost all types of materials that are handled in bulk bags.

FIG. 8 is a side view of bulk bag 29b placed on adjustable bag hopper 114 with bottom actuators 107a and 107b inflated to raise massage paddles 104a and 104b respectively to an angle of about 45 degrees. Actuators 107a and 107b may be inflated one or more times to break up and loosen material 29c in bag 29b for agitation purposes.

FIG. 9 is a side view of adjustable bag hopper 114 with bottom actuators 107a and 107b; and top actuators 108a and 108b fully inflated to raise massage paddles 104a and 104b to an angle of approximately 80 to 90 degrees to provide complete emptying of bag 29b. Internal hopper ring may be used with hopper flange ring 92 with vibrator 116 to aid in material discharge of a bulk bag. Because the adjustable bag hopper 114 can perform the complete discharge function for emptying bulk bags, which includes the agitation and massage function to break up caked and compacted materials; and also the ability to completely empty a bag without stretching it, adjustable bag hopper 114 may be mounted on portable unloaders, mixers and other types of vessels and equipment that bulk bags may be emptied from for applications that have in restricted head room areas and other space constraints.

FIG. 10 is a top view of mounting base 101 with bottom actuator manifold 117a and bottom pressure regulator 118a assembly that supplies air to bottom actuators 107a, 107b, 107c, 107d, 107e, 107f, 107g and 107h through air lines 120a, 120b, 120c, 120d, 120e, 120f, 120g and 120h respectively. Top actuator manifold 117b and top pressure regulator 118b may supply air to top actuators 108a, 108b, 108c, 108d, 108e, 108f, 108g and 108h through air lines 119a, 119b, 119c, 119d, 119e, 119f, 119g and 119h respectively. Valves 121 (not shown) may control air-flow from compressors or other air sources to actuator manifolds 117a

and 117b and pressure regulators 118a and 118b on a manual or automatic basis. Valves may be controlled by a PLC and or adjusted manually according to a particular discharge process.

FIG.11 is an end view of unloader 20 with bag 29j lifted over bag platform hopper 85j for discharge. Bag 29f on pallet 84 is placed between front posts 22a and 22d (not shown) of unloader 20 so that it is ready for placement on bag platform hopper 85j once bag 29j is emptied. The footprint of unloader 20 and bag 29f is typically smaller than the footprint of a cantilevered unloader (not shown) because the bag staged 29f is inside frame post 22a and 22d (not shown) of unloader 20. Because bag platform hopper 85j is off center and positioned towards the back of unloader also allows for a smaller footprint than conventional, cantilevered I-Beam unloaders.

FIG. 12 is a front view of unloader 20 having multiple bag platform hoppers 85h, 85i and 85j. A single unloader 20 frame can be used to unload bags 29h, 29i and 29j on bag platform hoppers 85h, 85i and 85j respectively because the frame design does not require I-beam's 23h, 23i and 23j to be cantilevered. Also, because I-Beam's 23h, 23i and 23j are not cantilevered, unloader frame 20 does not require cross bracing supports as conventional cantilevered frames. Unloader 20 provides a single frame for multiple bag discharge locations that allows costs to be lower and smaller space requirements.

While there have been described what are at present considered to be the preferred embodiments of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, aimed to cover all such changes and modifications as fall within the true spirit and scope of the invention.